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Health-Related Quality of Life and Disability Among Older New Zealanders With Kidney Failure: A Prospective Study

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Abstract

Background: Disability is prevalent in individuals with kidney failure and can contribute to significantly reduced quality of life and survival. In older individuals with kidney failure, disability can be caused by a combination of factors, including issues directly related to their kidney disease and/or treatment, including weakness, low energy, and low activity. Few studies have investigated health-related quality of life (HRQoL) as a possible predictor of disability among older individuals experiencing kidney failure.

Objective: This study aimed to determine if patient-reported HRQoL, and/or other factors at baseline, predicts disability in people with kidney failure, aged ≥65 years, after 12 months of follow-up.

Design: The DOS65+ study was an accelerated longitudinal cohort design comprising of both cross-sectional and longitudinal components. Participants were eligible if they were aged ≥65 years, had chronic kidney disease stage 5G (CKD 5G) (estimated glomerular filtration rate (eGFR) <15 ml/min/1.73 m^2), and had: commenced kidney replacement education, or were on an active conservative pathway, or were newly incident dialysis patients commencing dialysis therapy or prevalent on dialysis.

Setting: Three New Zealand District Health Board (DHB) nephrology units (Counties Manukau, Hawke's Bay, and Southern DHB) were involved in the study.

Participants: Participants were eligible if they were aged ≥65 years, had CKD 5G (eGFR <15 ml/min/1.73 m^2), and had: commenced kidney replacement education, or were on an active conservative pathway, or were newly incident dialysis patients commencing dialysis therapy or prevalent on dialysis.

Measurements: Disability and HRQoL were measured by EQ-5D-3L, a WHO Disability Assessment Schedule (WHODAS) 2.0.

Methods: Baseline and 12-month data from our longitudinal dialysis outcomes in older New Zealanders' study were analyzed to determine if HRQoL at baseline predicted disability outcomes 12 months later.

Results: Of the 223 participants at baseline, 157 participants completed a follow-up interview 12 months later. Individuals with "considerable disability" at baseline had a significantly (86%) higher risk of experiencing "considerable disability" at 12 months compared with those with "lesser/no disability" at baseline. Two thirds of those with ≥3 comorbidities were experiencing "considerable disability." In addition, those with problems with EQ-5D-3L self-care, EQ-5D-3L usual activities, and EQ-5D-3L anxiety/depression reported higher rates of disability.

Limitations: Selection bias is likely to have been an issue in this study as participants were excluded from the follow-up interview if they had an intercurrent illness requiring hospitalization within 2 weeks of the survey interview or if the treating nephrologist judged that the individual's ability to take part was significantly impaired. Sample size meant there were a limited number of explanatory/confounding variables that could be investigated in the multivariable model.

Conclusions: EQ-5D-3L mobility and self-care may be useful in predicting subsequent disability for individuals with CKD 5G. Although individuals with kidney failure often experience disability, previous studies have not clearly identified HRQoL or disability as predictors of later disability for individuals with kidney failure. Therefore, we would recommend the assessment of mobility and self-care, in conjunction with existing disabilities in the clinical review and pre-dialysis education of individuals with kidney failure as they approach the need for kidney replacement therapy.

Trial registration: the Australian and New Zealand clinical trials registry: ACTRN12611000024943.

Keywords

kidney failure, dialysis, older age group, patient-centered outcomes, disability, quality of life outcomes.

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Introduction

Like most developed countries, New Zealand (NZ) has seen a considerable increase in older individuals initiating dialysis therapy,[1] yet these individuals are profoundly affected by symptoms related to their kidney failure, as well as other comorbidities, which often results in an unacceptably poor quality of life.[2,3] Disability is prevalent in individuals with kidney failure[4] and can contribute to significantly reduced quality of life and survival.[5] In older kidney failure patients (either on dialysis or not), disability can be caused by a combination of factors, including issues directly related to their kidney disease and/or treatment, including weakness, low energy, and low activity. In addition, common geriatric problems such as falls, cognitive impairment, incontinence, and polypharmacy often contribute to disability and poor outcomes, including hospitalization and death in this group of older kidney failure patients.[6-9] Superimposed on these burdens are the intensive health service interventions associated with dialysis therapy, which further contribute to increased disability and functional decline. For many older patients, the overall burden of dialysis care may outweigh the benefits.[10-18]

Few studies have investigated health-related quality of life (HRQoL) among older individuals experiencing kidney failure. Previous findings from our longitudinal dialysis outcomes in older New Zealanders study (DOS65+ study)[19,20] have found that HRQoL, as measured by the EQ-5D-3L,[21] is an important determinant of subsequent overall health reported among older people treated for kidney failure. However, it appears that no studies have yet been published reporting HRQoL in relation to disability outcomes for this older age group with kidney failure—including for those on dialysis. Health-related quality of life is a possible predictor of disability as kidney failure can result in functional limitations. Functional limitations are assessed within most measures of HRQoL and are also explicitly considered within the World Health Organization's model of disability—the International Classification of Functioning, Disability and Health.[22] It is therefore essential that we have good quality HRQoL and disability data in older individuals with kidney failure, to actively involve them in decision-making and management in relation to their end-stage kidney disease. It is also important to have realistic treatment goals that reflect patient preferences and expectations within their own psychosocial context, as well as linked to the patient's comorbidities and prognosis.[23-27]

This study aimed to determine if patient-reported HRQoL, and/or other factors at baseline, predicts the self-perceived disability in people with kidney failure, aged ≥65 years, after 12 months of follow-up in the DOS65+ study.[28,29] Findings will help clinicians and patients to make informed decisions prior to commencing the dialysis on the post-dialysis disability as perceived by them, one of the more common questions individuals ask during the decision making phase.

Methods

Design

The DOS65+ study protocol and baseline data have previously been described.[28,29] The DOS65+ study was an "accelerated longitudinal cohort design" comprising of both cross-sectional and longitudinal components. Participants were eligible if they were aged ≥65 years, had chronic kidney disease stage 5G (CKD 5G; estimated glomerular filtration rate (eGFR) <15 ml/min/1.73 m^2), and had: commenced kidney replacement education, or were on an active conservative pathway, or were newly incident dialysis patients commencing dialysis therapy or prevalent on dialysis. Three NZ District Health Board (DHB) nephrology units (Counties Manukau, Hawke's Bay, and Southern DHB) were involved in the study. Counties Manukau is a tertiary nephrology unit that serves a large urban population with high numbers of Māori (Indigenous people of NZ) and Pacific people and those in lower socioeconomic groups. Hawke's Bay is a provincial rural center with a relatively higher proportion of Māori. Southern DHB is a tertiary nephrology center with a more geographically dispersed population, with an exclusive home dialysis policy.[28,29] New Zealand has a tax-funded public health care system accessible to all citizens. As such, NZ is well suited to outcomes research for patients with kidney failure because there are neither direct health care costs related to dialysis incurred by patients nor financial incentives for health care professionals that may affect treatment choice or provision of kidney failure management.[28,29]

All consenting patients who met the study inclusion criteria were contacted by telephone to arrange an interview, and all interviews were completed either by telephone or face-to-face by the DOS65+ research interviewer team, who were

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independent of the nephrology team providing patient care.[28,29] Patients were interviewed at baseline, and yearly thereafter for 3 years. At the time of each interview the participants had to be clinically stable, with no recent intercurrent illness requiring hospitalization within 4 weeks. They were also excluded from interviews if the treating nephrologist deemed them to be unsuitable (ie, for reason of a terminal diagnosis or a serious cognitive impairment making an interview impossible).[28,29] This analysis uses data collected in the first year of the DOS65+ study.

DOS65+ received ethical approval from the NZ Multi-Regional Ethics Committee (MEC/10/084), and the study was prospectively registered with the Australian and NZ clinical trials registry: ACTRN12611000024943.

Outcome

The main objective of this analysis was to determine if HRQoL at baseline, measured using the EQ-5D-3L,[20] predicted disability outcomes as measured by the WHO Disability Assessment Schedule (WHODAS) 2.0[29] 12 months later. The EQ-5D-3L[20] asks about health status today across 5 dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) with 3 responses per dimension assessing the problem severity (ie, no, moderate, or extreme). As cognitive function is also an important aspect of older people's health, an additional (non-EQ-5D-3L) question asked participants if they had no problems, moderate problems, or were unable to perform intellectual activities. For the analysis of the EQ-5D-3L and the cognitive functioning question, the categories of moderate or extreme problems were combined, creating a new category of "Any problems."

The main outcome of interest was disability as measured using WHODAS, a brief 12-item questionnaire, that provides an overall standardized assessment of self-reported disability.[30] It provides individuals' perspectives on how their disability affects them. WHO Disability Assessment Schedule assesses disability with 12 questions across 6 dimensions (cognition, mobility, self-care, getting along [interacting with others], life activities, and participation in community activities).[30] Participants were asked how much difficulty (while using any aids or appliances) they had over the past 30 days, rating difficulty using 5 severity levels (no, moderate, severe, extreme, cannot do) for each of the 12 questions. Severity levels were coded from 0 to 4, respectively, allowing participants to have a simple summed score of between 0 (no disability) and 48 (maximum disability). For those missing a response to 1 question the average of the remaining 11 responses was imputed in place of the missing response, when calculating the overall WHODAS score.[31,32] Scores were not calculated for participants with 2 or more missing responses. Participants who had a WHODAS score of 0 to 9 were classified as experiencing "lesser/no disability," whereas those with a score of 10 to 48 were classified as experiencing "considerable disability."[31]

Additional explanatory variables included in analyses were: sex, age, comorbidities, ethnicity,[33] dialysis vintage, living arrangements, and type of dialysis/dialysis location. Clinical information was collected, with participant consent, from health records by the nephrologists responsible for that individual's care. For multivariable analyses, participants were grouped according to the number of comorbid conditions they experienced (0-2 or >3).[28]

Statistical Analyses

Baseline descriptive analyses were completed to compare the characteristics of those with "lesser/no disability" (WHODAS <10) and "considerable disability" (WHODAS ≥10). Chi-squared tests were used to examine differences in participant characteristics according to disability status. Analyses were undertaken to determine which variables predicted disability at 12 months. The relative risks (RRs) of disability were estimated using modified Poisson regression with robust SEs.[34] This allows direct estimation of RRs of disability instead of odds ratio that can be estimated using logistic regression which is known to be an over-estimator for the RR.[34]

Initially, a series of univariate analyses was done separately for each explanatory characteristic to compare the characteristics of those reporting "lesser/no disability" and "considerable disability." Table 1 presents all variables initially included; treating DHB was used as cluster variable instead of a possible predictor. Following this, a multivariable model was completed to identify "significant" predictors from explanatory variables, and to estimate the independent effect of each predictor after accounting for other confounders. All variables were initially included and the backward selection procedure was used to identify predictors using a *P*-value threshold of ≤.1 to retain variables. All analyses were completed using Stata 15.1® software.[35]

Results

Baseline Characteristics at Time of Recruitment

Of the 225 participants enrolled in the study, 2 had missing data for either the HRQoL or WHODAS variables, and were excluded from analyses. Baseline demographic data as well as EQ-5D-3L and WHODAS scores are described in Table 1. A higher proportion of participants were male, and a greater proportion were aged 65 to 74 years. Forty-eight percent of participants were on hemodialysis (HD) compared with 27% on peritoneal dialysis (PD). In addition, 55 participants with CKD 5G had not commenced dialysis, and 8 had only just commenced dialysis training (<90 days). Because training was incomplete, these 8 participants were not allocated to a dialysis location of either home or center; however, they were included in the dialysis vintage grouping.

Table 1. Baseline Descriptive Characteristics of the Participants (N = 223).

Variable	N	%
Sex		
Male	143	64
Female	80	36
Age group		
<75 years	150	67
75+ years	73	33
Ethnicity		
Non-Māori, non-Pacific	122	55
Māori	49	22
Pacific	52	23
DHB		
Counties Manukau	150	67
Hawke's Bay	29	13
Otago	44	20
Dialysis location		
At home (HD + PD)	68	31
In center	92	41
Non-dialysis or training	63	28
Dialysis vintage		
Non-dialysis	55	25
<2 years	87	39
≥2 years	81	36
Treatment type		
HD	108	48
PD	60	27
Non-dialysis	55	25
Number of comorbidities		
0-2	104	47
3+	119	53
Adequate income		
Just or not enough	120	54
Enough or more than enough	102	46
BMI		
<30 kg/m^2	121	54
30+ kg/m^2	102	46
Highest educational qualification		
School	110	49
Tertiary	113	51
Living arrangements		
With others	191	86
Alone	32	14
Disability at baseline (WHODAS 2.0)		
WHODAS <10	101	45
WHODAS ≥10	122	55
EQ-5D-3L mobility		
No problems	90	40
Moderate to severe problems	133	60
EQ-5D-3L self-care		
No problems	163	73
Moderate to severe problems	60	27
EQ-5D-3L usual activities		
No problems	91	41
Moderate to severe problems	132	59
EQ-5D-3L anxiety/depression		
No problems	181	81
Moderate to severe problems	42	19
EQ-5D-3L pain/discomfort		
No problems	121	54
Moderate to severe problems	102	46
Cognitive function		
No problems	152	68
Moderate to severe problems	71	32

Note. DHB = District Health Board; HD = hemodialysis; PD = peritoneal dialysis; BMI = body mass index; WHODAS = WHO Disability Assessment Schedule.

At baseline, 45% of the participants were categorized as reporting "lesser/no disability" and 55% as "considerable disability." The majority of participants reported no problems with EQ-5D-3L self-care or anxiety/depression, or cognitive functioning. However, 59% reported problems with EQ-5D-3L usual activities, and 46% with pain/discomfort. The majority of participants lived with others (86%).

Predictors of Disability at 12 Months

Of the 223 participants at baseline, 157 participants completed a follow-up interview 12 months later. Table 2 describes the disability status of participants after 12 months follow-up according to the baseline characteristics of the participants. Two thirds of those with ≥3 comorbidities were experiencing "considerable disability." In addition, those reporting problems with EQ-5D-3L mobility were more likely to have considerable disability, as were those with problems with EQ-5D-3L self-care, EQ-5D-3L usual activities, and EQ-5D-3L anxiety/depression.

Sixty-six participants were either lost to follow-up or had died prior to the 12-month interview. Table 3 presents the univariate RRs of considerable disability at 12 months according to baseline characteristics. The univariate analyses indicate reporting problems with EQ-5D-3L mobility, EQ-5D-3L self-care, EQ-5D-3L usual activities, cognitive function, and "considerable disability" at baseline may predict disability 12 months later. There were no differences in the risk of considerable disability according to dialysis modality (HD or PD), dialysis vintage, or those dialyzing at home or in center compared with non-dialyzing patients.

In the multivariable model (Table 4), those who were experiencing disability at baseline had an 86% increased risk of considerable disability 12 months later (RR = 1.86, 95%

Table 2. Disability of Participants After 12 Months Follow-up According to the Baseline Characteristics of the Participants (N = 157).

	Not disable (WHODAS <10)		Disable (WHODAS ≥10)		
Baseline characteristic	N (total = 67)	%	N (total = 90)	%	*P*-value
Sex					.054
Male	48	48	51	52	
Female	19	33	39	67	
Age					.311
<75	49	45	59	55	
75+	18	37	31	63	
BMI					.152
<30 kg/m^2	39	48	42	52	
30+ kg/m^2	28	37	48	63	
Ethnicity					.865
Non-Māori, non-Pacific	36	41	52	59	
Māori	17	46	20	54	
Pacific	14	44	18	56	
Highest educational qualification					.144
Tertiary	24	52	22	48	
School	43	39	66	61	
Adequacy of income					.581
Just or not enough	35	41	51	59	
Enough or more than enough	32	45	39	55	
Living arrangements					.352
With others	60	44	76	56	
Alone	7	33	14	67	
DHB					.103
Counties Manukau	42	39	66	61	
Hawke's Bay	8	38	13	62	
Otago	17	61	11	39	
Treatment type					.246
Non-dialysis	15	38	25	63	
Hemodialysis	38	49	39	51	
Peritoneal dialysis	14	35	26	65	
Dialysis location					.958
Non-dialysis (includes training)	21	44	27	56	
At home	20	43	26	57	
In center	26	41	37	59	
Dialysis vintage					.151
Non-dialysis	15	38	25	63	
<2 years	21	36	37	64	
2+ years	31	53	28	47	
Number of comorbidities					.167
0-2	38	48	41	52	
3+	29	37	49	63	
EQ-5D-3L mobility					<.001
No problems	44	63	26	37	
Moderate to severe problems	23	26	64	74	
EQ-5D-3L self-care					<.001
No problems	60	51	58	49	
Moderate to severe problems	7	18	32	82	
EQ-5D-3L usual activities					<.001
No problems	41	62	25	38	
Moderate to severe problems	26	29	65	71	
EQ-5D-3L pain					.102

(continued)

Table 2. (continued)

Baseline characteristic	Not disable (WHODAS <10) N (total = 67)	%	Disable (WHODAS ≥10) N (total = 90)	%	*P*-value
No problems	43	48	46	52	
Moderate to severe problems	24	35	44	65	
EQ-5D-3L anxiety					.250
No problems	57	45	70	55	
Moderate to severe problems	10	33	20	67	
Cognitive function					.033
No problems	53	48	57	52	
Moderate to severe problems	14	30	33	70	
Disability at baseline					<.001
WHODAS <10	52	64	29	36	
WHODAS ≥10	15	20	61	80	

Note. Of the 157 participants, 1 did not have information about dialysis vintage available in their clinical record and was therefore not included in the analyses for that variable. In addition, 2 participants did not provide information about their level of education and are not included in the analyses for that variable. WHODAS = WHO Disability Assessment Schedule; BMI = body mass index; DHB = District Health Board.

Table 3. Univariate Analysis of Risk of WHODAS ≥10 After 12 Months Follow-up According to Characteristics of the Participants (N = 157).

Variable	Relative risk	95% CI	*P*-value	Overall *P*-value[a]
Sex				
Male	Ref			
Female	1.31	1.00-1.70	.047	
Age group				
<75 years	Ref			
75+ years	1.16	0.88-1.52	.295	
Ethnicity				
Non-Māori, non-Pacific	Ref			.870
Māori	0.91	0.65-1.29	.613	
Pacific	0.95	0.67-1.35	.784	
Highest educational qualification (n = 155)				
Tertiary	Ref			
School	1.27	0.90-1.78	.172	
Treatment type				
Non-dialysis	Ref			.255
PD	1.04	0.75-1.45	.817	
HD	0.81	0.58-1.12	.208	
Dialysis vintage (n = 156)				
Non-dialysis	Ref			.151
<2 years	1.06	0.78-1.45	.693	
≥2 years	0.77	0.53-1.11	.195	
Number of comorbidities				
0-2	Ref			
3+	1.21	0.92-1.59	.171	
BMI				
<30 kg/m^2	Ref			
30+ kg/m^2	1.22	0.93-1.60	.155	
Dialysis location				
Non-dialysis	Ref			.958
At home (HD + PD)	1.00	0.70-1.44	.979	
In center	1.04	0.75-1.45	.795	

(continued)

Table 3. (continued)

Variable	Relative risk	95% CI	*P*-value	Overall *P*-value[a]
Adequate income				
Enough or more than enough	Ref			
Just or not enough	1.08	0.82-1.42	.585	
Living arrangements				
With others	Ref			
Alone	1.19	0.85-1.67	.307	
EQ-5D-3L mobility				
No problems	Ref			
Moderate to severe problems	1.98	1.42-2.76	<.000	
EQ-5D-3L self-care				
No problems	Ref			
Moderate to severe problems	1.67	1.32-2.11	<.000	
EQ-5D-3L usual activities				
No problems	Ref			
Moderate to severe problems	1.89	1.35-2.64	<.000	
EQ-5D-3L pain/discomfort				
No problems	Ref			
Moderate to severe problems	1.25	0.96-1.64	.100	
EQ-5D-3L anxiety/depression				
No problems	Ref			
Moderate to severe problems	1.21	0.90-1.63	.212	
Cognitive function				
No problems	Ref			
Moderate to severe problems	1.35	1.04-1.76	.022	
Disability at baseline (WHODAS 2.0)				
WHODAS <10	Ref			
WHODAS ≥10	2.24	1.64-3.07	<.000	

Note. WHODAS = WHO Disability Assessment Schedule; CI = confidence interval; BMI = body mass index; HD = hemodialysis; PD = peritoneal dialysis.
[a]Overall *P*-value refers to the *P*-value which was calculated when there was more than 1 *P*-value presented for an explanatory variable.

CI = 1.36-2.63; $P < .001$) compared with those with "lesser/no disability" at baseline. Those with EQ-5D-3L self-care problems had a 31% increased risk (RR = 1.31, 95% CI = 1.04-1.67; $P = .025$) of disability, and those with EQ-5D-3L mobility problems had a 38% increased risk (RR = 1.38, 95% CI = 1.00-1.89; $P = .048$) compared with those with no problems in those dimensions at baseline. Females were at a 31% increased risk of "considerable disability" (RR = 1.31, 95% CI = 1.03-1.67; $P = .0137$) compared with men. There were no differences related to ethnicity.

In terms of dialysis vintage, those dialyzing for 2 or more years had a 61% (RR = 0.39, 95% CI = 0.17-0.88) lower risk of "considerable disability" compared with the non-dialysis group. Those dialyzing for a shorter period of time (0-2 years) also appear to have a lower risk, but failed to observe its statistical significance (RR = 0.54, 95% CI = 0.24-1.21; Table 4). In addition, those dialyzing at home were at increased risk of considerable disability (RR = 2.29, 95% CI = 1.00-5.21) compared with those not dialyzing.

A separate sub-analysis using only the individuals who were on dialysis at the baseline (HD = 108, PD = 60; Table 5) was conducted. Location was removed from this sub-analysis as location of dialysis therapy in NZ is often determined by the type of dialysis, with those on HD being more likely to be in center and those on PD are dialyzing at home. Apart from a lower proportion of Māori or Pacific people on PD and a tendency for more females on HD, HD and PD patients had similar characteristics. There was no difference in the proportions reporting disability between the HD and the PD patients at baseline or at 12 months.

Twelve months later, 52 had died, were too unwell to be interviewed, or were lost to follow-up, leaving 116 dialyzing patients with data available for analyses. In multivariable analyses similar to above for dialyzing patients with no variables being fixed (Table 6), those reporting considerable disability at baseline had a 62% (RR = 1.62, 95% CI = 1.10-2.38, $P = .015$) higher risk of being disabled compared with those with "lesser/no disability." There were no differences related to ethnicity. In addition, those dialyzing for 2 or more years had a 27% (RR = 0.73, 95% CI = 0.55-0.98, $P = .036$) reduced risk of experiencing disability compared with those dialyzing for less than 2 years. Those with

Table 4. Multivariable Analysis of Variables Predicting WHODAS ≥10 Representing "Considerable Disability" at 12 Months (n = 156).

Variable	Relative risk	95% CI	*P*-value	Overall *P*-value
Sex				
Male	Ref			
Female	1.31	1.03-1.67	.014	
Dialysis vintage				
Non-dialysis	Ref			
<2 years	0.54	0.24-1.21	.23	.091
≥2 years	0.39	0.17-0.88	.048	
Dialysis location				
Non-dialysis	Ref			
At home (HD + PD)	2.29	1.00-5.21	.048	.014
In center	1.75	0.80-3.85	.160	
EQ-5D-3L mobility				
No problems	Ref			
Moderate to severe problems	1.38	1.00-1.89	.048	
EQ-5D-3L self-care				
No problems	Ref			
Moderate to severe problems	1.31	1.04-1.67	.025	
Disability at baseline (WHODAS 2.0)				
WHODAS <10	Ref			
WHODAS ≥10	1.86	1.36-2.53	<.001	

Note. Variables included but not retained; age, ethnicity, number of comorbidities, living arrangements, EQ-5D-3L usual activities, EQ-5D-3L pain/discomfort, EQ-5D-3L anxiety/depression, and cognitive function. WHODAS = WHO Disability Assessment Schedule; CI = confidence interval; HD = hemodialysis; PD = peritoneal dialysis.

problems with EQ-5D-3L self-care at baseline had a 38% (RR = 1.38, 95% CI = 1.03-1.85, $P = .030$) higher risk of considerable disability at 12 months compared with those with no problems. Problems with EQ-5D-3L usual activities were at a 54% (RR = 1.54, 95% CI = 0.99-2.40, $P = .058$) higher risk of disability; however, this finding did not reach statistical significance.

To assess the possible bias due to a large proportion (30%) of participants lost to the 12-month follow-up, the characteristics of those followed to 12 months were compared with those only interviewed at baseline. Pearson's chi-squared test was used to compare the characteristics of the 67 participants not followed up with the 156 participants interviewed at 12 months (Table 7). The only difference observed between the 2 groups was in baseline disability, with a higher proportion of those experiencing considerable disability at baseline being lost to follow-up. There was also a tendency toward a higher proportion of individuals with more comorbidities and impaired EQ-5D-3L mobility to not be followed up for 12 months; however, neither of these differences were statistically significant.

Discussion

Utilizing data from our DOS65+ study,[27,28] we examined which HRQoL factors, including the various EQ-5D-3L dimensions, were predictors of disability, as measured by WHODAS, after 12 months of follow-up. We have shown that EQ-5D-3L mobility and self-care may be useful in predicting subsequent or progressive disability for individuals with CKD 5G. Studies have consistently demonstrated that individuals with CKD prioritize quality of life, mental health, impact on family, fatigue, mobility, and employment as important factors in making treatment decisions.[22,26,35–37] As the number of older individuals experiencing kidney failure continues to increase, the impact of dialysis can be profoundly affected by not only symptoms related to kidney failure, but other comorbidities including disability, as well as HRQoL factors.

At the time of recruitment, the majority of participants reported no problems with either EQ-5D-3L self-care (73%) or EQ-5D-3L anxiety/depression (81%), and no concerns with a similar question asking about cognitive functioning (68%). However, 59% of participants reported problems with EQ-5D-3L usual activities and 46% reported problems with EQ-5D-3L pain/discomfort (Table 2). In addition, at baseline, 55% of participants reported "considerable disability," which suggests disability is prevalent among those with kidney failure. This suggests that consideration of patients' issues with usual activities and pain/discomfort may be important when attempting to enable individuals to minimize the impact of subsequent disability. These findings are similar to those of

Table 5. Baseline Descriptive Statistics of HD (n = 108) and PD (n = 60).

Variables	HD	%[a]	PD	%[a]	*P*-value
Sex					.053
Male	63	59	44	41	
Female	45	74	16	26	
Age group					.595
<75 years	78	66	41	34	
75+ years	30	61	19	39	
Ethnicity					.004
Non-Māori, non-Pacific	43	52	40	48	
Māori	30	77	9	23	
Pacific	35	76	11	24	
Dialysis vintage					.108
<2 years	49	57	37	43	
≥2 years	58	72	23	28	
Number of comorbidities					.854
0-2	52	65	28	35	
3+	56	64	32	36	
Living arrangements					.620
With others	98	65	53	35	
Alone	10	59	7	41	
EQ-5D-3L mobility					.373
No problems	41	60	27	40	
Moderate to severe problems	67	67	33	33	
EQ-5D-3L self-care					.584
No problems	73	63	43	37	
Moderate to severe problems	35	67	17	33	
EQ-5D-3L usual activities					.088
No problems	36	56	28	44	
Moderate to severe problems	72	69	32	31	
EQ-5D-3L pain/discomfort					.285
No problems	65	68	31	32	
Moderate to severe problems	43	60	29	40	
EQ-5D-3L anxiety/depression					.931
No problems	87	64	48	36	
Moderate to severe problems	21	64	12	36	
Cognitive function					.538
No problems	65	63	39	38	
Moderate to severe problems	43	67	21	33	
Disability at baseline (WHODAS 2.0)					.945
WHODAS <10	48	64	27	36	
WHODAS ≥10	60	65	33	35	
Disability at 12 months (WHODAS 2.0)					.280
WHODAS <10	38	73	14	27	
WHODAS ≥10	39	60	26	40	
Participants not followed for 12 months	31	61	20	39	

Note. HD = hemodialysis; PD = peritoneal dialysis; WHODAS = WHO Disability Assessment Schedule.
[a]Row percentages are presented.

Cook and Jassal[38] who found that disability was prevalent in older adults on HD making self-care and independence more difficult. Apostolou[10] identified that physical decline, associated with reduced ability to perform usual activities (which may or may not lead to pain/discomfort), is important in influencing quality of life. However these were cross-sectional studies, this study has the additional strength of being a prospective study.

Table 6. Multivariable Analyses of Variables Predicting WHODAS ≥10 Representing "Considerable Disability" at 12 Months, Among Older Dialysis Patients (n = 116).

Variable	Relative risk	95% CI	*P*-value
Dialysis vintage			
<2 years	Ref		
≥2 years	0.73	0.55-0.98	.036
EQ-5D-3L self-care			
No problems	Ref		
Moderate to severe problems	1.38	1.03-1.85	.030
EQ-5D-3L usual activities			
No problems	Ref		
Moderate to severe problems	1.54	0.99-2.40	.058
Disability at baseline (WHODAS 2.0)			
WHODAS <10	Ref		
WHODAS ≥10	1.62	1.10-2.38	.015

Note. Variables included but not retained in the model; sex, age group, ethnicity, number of comorbidities, living arrangements, EQ-5D-3L mobility, EQ-5D-3L pain/discomfort, and EQ-5D-3L anxiety/depression. WHODAS = WHO Disability Assessment Schedule; CI = confidence interval.

In terms of HRQoL, participants with problems with EQ-5D-3L mobility and self-care were more likely to experience "considerable disability" at 12 months (Table 2) compared with those with no problems with these dimensions at baseline. Therefore, it appears the EQ-5D-3L mobility and self-care may be useful in predicting subsequent disability for kidney failure patients. Likewise, individuals with "considerable disability" at baseline had a significantly (86%) higher risk of experiencing "considerable disability" at 12 months compared with those with "lesser/no disability" at baseline (Table 4). While this seems a subjective measure of outcome, disability as self-perceived by patients is important for them when deciding treatment plans, at least to the level of objective measures, if not more. It has not previously been confirmed in a prospective study. Although individuals with kidney failure often experience disability,[38–40] previous studies have not clearly identified disability as a predictor of later disability for individuals with kidney failure. Therefore, we would recommend the assessment of mobility and self-care, in conjunction with existing disabilities in the clinical review and pre-dialysis education of individuals with kidney failure as they approach the need for kidney replacement therapy. These results are important for future patient and family education, when discussing the potential impact of dialysis on the individual, to reduce any possible misunderstanding as to the "benefits" of dialysis with respect to existing disabilities.

Our multivariable analyses found that females had a 31% higher risk of "considerable disability" at 12 months compared with men (Table 4). Previous studies have not noticed a difference in disability between males and females.[37,38] As a possible explanation, females traditionally were the homemakers among older New Zealanders, and therefore they may do more around the home than males, meaning that their experience of disability could be greater than males. However, this observation requires further research to identify what underpins the higher risk of disability for women that we have observed. In this study, the majority of home dialysis patients were on PD, which is a simpler dialysis modality and allows for more independence at home, despite significant comorbidities and disabilities. In NZ, individual preferences with clinical guidance largely dictate the treatment modality chosen and therefore the outcomes, where possible home-based dialysis is strongly supported.

Of interest, those who dialyzed for 2 years or more had a 61% (RR = 0.39, 95% CI = 0.17-0.88) lower risk of "considerable disability" compared with those who were not dialyzing. A plausible explanation for this is that this is a self-selected group with improved survival (increased dialysis vintage) due to likely having little or no comorbidities upon commencing dialysis. In NZ, survival after commencing dialysis in the 65- to 74-year-old age group is 87% at 12 months, 73% at 2 years, and 37% at 5 years.[1] For those aged 75 to 84 years, survival is 81% at 12 months, 64% at 2 years, and 19% at 5 years.[1]

The result from this study demonstrates another important finding for informing individuals and their families about the impact of dialysis. For those individuals, who with "lesser/no disability" at the initiation of dialysis can expect less of an impact of dialysis on any subsequent disability. Specifically, for the dialyzing participants, longer dialysis vintage predicts the lower likelihood of "considerable disability" at 12 months, while moderate to severe problems with EQ-5D-3L self-care and "considerable disability" at baseline predict the "considerable disability" at 12 months. This information may be important in assisting individuals and families in making the best decision for their individual situations and contexts.

Selection bias is likely to have been an issue in this study as participants were excluded from the follow-up interview if

Table 7. Characteristics of Participants Followed Up at 12 Months (n = 156) Compared With Baseline-Only Participants (n = 67).

Baseline characteristics	Baseline (n = 67)	%[a]	Followed to 12 months (n = 156)	%[a]	*P*-value
Sex					
Male	45	67	98	63	.535
Female	22	33	58	37	
Age group					
<75 years	43	64	107	69	.520
75+ years	24	36	49	31	
Ethnicity					
Non-Māori, non-Pacific	34	51	88	56	.314
Māori	13	19	36	23	
Pacific	20	30	32	21	
Dialysis vintage					
Non-dialysis	15	22	39	25	.358
<2 years	29	43	58	37	
≥2 years	22	32	59	38	
Missing	2	3	0.0	0.0	
Dialysis location					
Non-dialysis	15	22	48	31	.444
At home (HD + PD)	22	33	46	29	
In center	30	45	62	40	
Number of comorbidities					
0-2	25	37	79	51	.067
3+	42	63	77	49	
Living arrangements					
With others	56	84	135	87	.564
Alone	11	16	21	13	
EQ-5D-3L mobility					
No problems	21	31	69	44	.072
Moderate to severe problems	46	69	87	56	
EQ-5D-3L self-care					
No problems	46	69	117	75	.327
Moderate to severe problems	21	31	39	25	
EQ-5D-3L usual activities					
No problems	26	39	65	42	.690
Moderate to severe problems	41	61	91	58	
EQ-5D-3L pain/discomfort					
No problems	32	48	89	57	.202
Moderate to severe problems	35	52	67	43	
EQ-5D-3L anxiety/depression					
No problems	55	82	126	81	.817
Moderate to severe problems	12	18	30	19	
Disability at baseline (WHODAS 2.0)					
WHODAS <10	21	31	80	51	.006
WHODAS ≥10	46	69	76	49	
Treatment type					
Non-dialysis	15	22	40	26	.772
HD	20	30	40	26	
PD	32	48	76	49	
Cognitive function					
No problems	43	64	109	70	.403
Moderate to severe problems	24	36	47	30	

Note. HD = hemodialysis; PD = peritoneal dialysis; WHODAS = WHO Disability Assessment Schedule.
[a]Column percentages have been presented.

they had an intercurrent illness requiring hospitalization within 2 weeks of the survey interview or if the treating nephrologist judged that the individual's ability to take part was significantly impaired.[28,29] This suggests that this cohort may potentially be healthier than the total population of older New Zealanders with kidney failure. Therefore, these findings may be underestimating the true strength of the associations and relationships between EQ-5D-3L and WHODAS.

It is possible that a small misclassification bias may have occurred in terms of dialysis location; 8 individuals who were "in training" at baseline (commenced dialysis less than 90 days at the time of first interview) were included in the non-dialysis group. Therefore, some of these participants may have been more appropriately included within the dialyzing group. However, given the small number of participants in the "in training group," this is unlikely to have significant effects on the overall results of the study.

Within this study, we added cognitive function as an important predictor variable for disability; however, it is possible that those who experience moderate to severe problems with cognitive function may have had issues with understanding the questionnaire which may have resulted in some respondents' results being unreliable, which may have resulted in bias. To avoid this bias, those experiencing cognitive impairment are frequently excluded from studies[9]; however, they were not excluded from this study despite the potential limitations. Cognitive function was not found to be a significant predictor of disability in this study.

Loss to follow-up, including death, would contribute to bias in this study. Of the 223 individuals who provided baseline data, 66 were lost to follow-up or had died and there was 1 with missing data. To assess possible bias, we compared the characteristics of the 67 participants who were not included in multivariable analysis with the 156 participants used in that analysis (Table 7). The only significant difference between the 2 groups was in baseline disability, with a higher proportion of those disabled at baseline lost to follow-up.

Due to the size of our sample (156 participants at 12 months), there were a limited number of explanatory/confounding variables that could be investigated in the multivariable model. Increasing the number of categories may have reduced the statistical power, as would have had the same effect of adding more explanatory variables. Also, even though the number of participants likely be sufficient for the number of variables retained in the final multivariable model (rule of thumb), intermediate models used to derive it involved more variables; therefore, there is a risk of possible overfitting of those intermediate models. However, we opted not to do a *P*-value-based univariable screening of variables to include in multivariable model building without guidance from content knowledge due to well-documented pros and cons of that approach.

It is important to integrate HRQoL measures into standardized clinical care with the purpose of improving patient outcomes.[11-13] Health-related quality of life is complex and spans many dimensions. Individuals may have problems with all dimensions or just some dimensions; therefore, investigating which areas of HRQoL individuals have problems with and then intervening in the particular area[40–42] may improve HRQoL in kidney failure patients and reduce the impact of disability. Preexisting disability will more likely progress with time on dialysis. Conversely, for those individuals who are healthier, with little or no disabilities at the initiation of dialysis, could expect little significant deterioration in their clinical status at least in the first 12 months of dialysis.

In summary, this study clearly demonstrates that the EQ-5D-3L mobility, EQ-5D-3L self-care, and "considerable disability" at baseline were associated with higher rates of "considerable disability" at 12 months. Baseline disability was the strongest predictor of disability at 12 months. Intuitively, this may seem obvious to clinicians; however, this is the first known time that it has been confirmed prospectively in a clinical study. This study focused on the EQ-5D-3L and the WHODAS measures which assess HRQoL and disability, respectively, from the perspective of the individual with kidney failure rather than the health professionals[36] in line with the Standardised Outcomes in Nephrology - Haemodialysis (SONG-HD)[23] and Standardised Outcomes in Nephrology - Peritoneal Dialysis (SONG-PD)[43] initiatives. The EQ-5D-3L and WHODAS are both robust, easy to understand, and easy to administer measures that allow for an assessment of individuals' perspectives which may improve the clinical experience and recommendations for them and their families.

Conclusion

We have demonstrated in a group of older people with kidney failure both on dialysis and pre-dialysis, that self-reported EQ-5D-3L measures of mobility, self-care, and "considerable disability" impact upon subsequent disabilities at 12 months. Individual and family participation in assessing these HRQoL components and baseline disability would help with kidney failure education and planning for kidney replacement therapy.

Ethical Approval

DOS65+ received ethical approval from the New Zealand Multi-Regional Ethics Committee (MEC/10/084). Trial registration: ACTRN12611000024943.

Authors' Note

The data is securely stored in the Department of Preventive and Social Medicine. It is not available in the public domain due to ethics requirements. Access to de-identified data for recognized research will be considered with appropriate application to the corresponding author.

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Author Contributions

Research idea and study design: R.W. and S.D. Student (E.B.) supervision: S.D., E.W., A.S., and R.W. Data acquisition: R.W., S.D., E.W., J.S., and A.S., wider DOS65+ team. Statistical analysis: E.B. and A.S. Data analysis and interpretation: E.B., A.S., S.D., R.W., and E.W. Preparation of manuscript: E.B., S.D., J.S., A.S., E.W., and R.W. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved.

Declaration of Conflicting Interests

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